CERAMICS

MARCH
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A monthly journal covering the whole ceramic field including pottery, glass, heavy clay, refractory and silicate industries.

Published Monthly
by
ARROW PRESS LTD.,
157 Hagden Lane,
Watford, Herts

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FEATURE ARTICLES

MISCELLANEOUS

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VOL. V MARCH, 1953 NO. 49

COMMENT

by ARGUS

ONCE again Mr. Gordon Russell, Director of the Council of Industrial Design has visited Stoke—it is about twelve months since he last told the British pottery manufacturers that it was necessary to stress the "contemporary idiom" in design, suggesting an exhibition in the United States two years from then. He urged the locking of art and technical education saying that art schools mostly taught how things were made by hand, and technical schools taught how things were made by industry, with little thought to design!

A Question of Demand

On that occasion, one well known potter commented that for thirty years the district had been told by various Government Departments that it was antiquated, out of date and backward in design ideas. He continued to say that Sweden, Czechoslovakia and pretty well the whole of Europe had at one time or another been considered more advanced than Britain, and now Mr. Russell was suggesting that America was ahead. Other speakers said that only a minority of buyers and potential buyers preferred contemporary design and by encouraging this the Council of Industrial Design might unwittingly do harm to the pottery export trade. Others stated that it would be futile to adopt contemporary design in present-day factories, for the overall demand was for traditional designs.

It was pointed out how contemporary design was very difficult to judge in terms of value. Many so-called examples of contemporary design would undoubtedly be just passing phases and there was no way really of obtaining a subjective view as to which designs would sell.

Altogether Mr. Russell, 12 months ago in the potteries, did not have a very happy time.

He came back, however, to the annual Prize Giving of the Stoke-on-Trent College of Art recently. On this occasion he was reserved in his comment, no doubt remembering his past experience in Stoke.

He did not refer directly to contemporary design, and certainly did not attempt to act as design adviser to the potteries. In fact, he went further and said that with few exceptions the pottery manufacturers were not seduced by the extravagance of so-called jazz designs and colourings in the 1920's. They continued to produce earlier patterns which remained

popular because they had real merit.

Yes, undoubtedly, a chastened Mr. Russell!

Costly Long-term affair

He went on to say: "The production of a new pottery design is a costly and long-term affair." It is, therefore, a matter of very much greater concern to your industry than to some others that new designs should be so excellent that, once launched, they will hold the field for a considerable period in the same way as the older designs have done. That some of them do not reach the necessary standard to make this probable is a serious matter.

"It may be argued that in the future, designs will change far more rapidly and that novelty will take the place of real worth. This, too, is a serious matter for the pottery industry, which has on the whole always put its money on quality. It is highly probable that the handling of design problems in your trade will have a great bearing on the prosperity of the Five Town's."

Mr. Russell strikes an important note when he says that new pottery design is a costly and long-term affair. That crystallises the careful approach of the potters to any new changes. It is all very well for a variety of people to suggest that this design or that design would be favourably received, but it is the potter who has to spend the money upon the design and therefore design changes in the pottery industry will naturally be slow—there are traditional designs which are still selling and any design development must be done slowly because there is no yardstick upon which to judge a design before it is actually available in production. By then, if it is a flop, the expense is considerable.

An Expensive Experiment

In all these questions of design, be they pottery or elsewhere, it is vital for the teaming numbers of people who have theoretical ideas on the subject to remember that design is very much a subjective appreciation. All works of art, be they pictures, plays, films, music, sculpture or anything else, when they break away from orthodox conception, have their antagonists and protagonists. On design, people with equal qualifications to express an opinion are often violently opposed. Potting is a commercial business and it is only to be expected that the potter who, after all, has to spend the money, will be a little conservative in drastic alterations, and indeed it is not out of place that the Council of Industrial Design, which has its guaranteed income, should be perhaps a little reckless in encouraging someone else to engage upon an expensive experiment.

Productive Capacity

One could, however, take up the cudgels with Mr. Russell on one of his statements in which he said "It was generally agreed that one of the causes of the astonishing productive capacity of America was in the much greater use of university graduates and the better training for management." Surely the productive capacity of America is based largely upon an almost unlimited supply of raw materials, something like three or four times the power at the elbow of the operative as compared with Britain, and a tremendous population which enabled tooling up in any commodity to be undertaken to three or four times the extent than in Britain. This tendency to assume that American productivity is *better* (not only *bigger*) than British and, therefore, that Britain should adopt American practice is woolly thinking in the extreme. The economic environment of the two countries is completely different. Some American ideas would be usefully applied over here and vice versa. But to begin any economic argument with the axiom that it is *better* in America and then to draw a conclusion is surely a fallacy.

However, congratulations to the potter, for the Mr. Gordon Russell who appeared on this occasion in Stoke was a much more illusioned character than the one who appeared twelve months ago.

Manesty Machines Ltd.—We have received a leaflet from this Company of Speke, Liverpool 19, dealing with their electrically heated drying ovens and a variety of other products including tablet machines, an oscillating granulator and their "H" type mixer.

Frits—Their Preparation and Applications

(SPECIALLY CONTRIBUTED)

A FRIT is a glass-like substance produced by heating together a number of substances capable of forming a glass. Although so akin to glasses the term frit is usually reserved to those substances which are an important ingredient in enamels and ceramic glazes and have on occasions been used in pottery bodies as additional fluxes.

Frits in Pottery Bodies

In the latter connection it is interesting to note that the first porcelain made in France in 1740 used a glassy frit instead of felspar, and thus differed from the Chinese porcelain. The frit was made from white sand, saltpetre, sea salt, alum, soda and gypsum, and the body comprised 75 per cent. frit, 17 per cent. chalk, 8 per cent. calcareous marl. This was made plastic with water, and soft soap and parchment size, and the articles were pressed in plaster moulds. The use of the soft frit persisted till 1770 when the French made a similar porcelain to the German and Oriental type. Attempts at reproducing the Oriental porcelain were made in England rather later than on the Continent, and the early attempts at Bow and Chelsea were of the French soft paste type, employing a frit as a flux. The advantage of using the frit was that it gave a vitreous body at a lower temperature than that required for the hard paste or Oriental type.

These bodies containing glass as frit were lacking in plasticity and other substances were added to improve this, including bone ash and soapstone. This led eventually to the abandoning of the fritted material and the introduction in England of bone china body by the younger Spode about 1800.

The use of a frit was revived in 1840 in Stoke-on-Trent in the body known as parian, which was a very fine medium for figures and statuary. This contained about 2·5 per cent. of flint glass as an additional flux, a recipe being:

China clay	40·0
Felspar	13·0
Ball clay	4·5
Stone	40·0
Flint glass	2·5

It was fired to about 1,300° C.

Today the use of frits in bodies has died out.

Frits Now Used in Enamels and Glazes

In glazes their use has led to the low solubility glazes, which have almost eliminated lead poisoning as an occupational disease in the pottery industry. In vitreous enamelling the use of high proportions of fritted material allows firing of enamels on sheet iron to be completed in 8-10 min. In this field the introduction of self-opacifying frits has made it possible to finish ware in one coat of enamel, with consequent benefit to the trade.

Manufacture of Frits

Frits are composed of certain basic materials which are glass-forming, together with small additions of other substances which are added for producing colour or opacity, or to adjust the coefficient of expansion so that it may more nearly approach that of the material to be glazed or enamelled. Borax, felspar, and quartz are the usually glass-forming materials in vitreous enamels and these often comprise about 80 per cent. of the frit, the rest being small but important additions of other fluxing materials, colourant, opacifier, etc.

Fritting involves the weighing out of the raw materials. Secrecy still prevails in some works over this, and to prevent the leakage of information devices are often employed to prevent employees knowing the exact recipe. The ideal set-up for fritting on a large scale involves storing the raw materials at the top of the building and having the frit kiln on the ground floor. The materials are then fed down by gravity. Thus from the top floor the raw materials can be taken from hoppers into a mixing car on the floor below. The latter can be equipped with a weighing machine and run on rails if necessary. This car can then discharge its contents to a drum mixer situated on the floor below and, after suitable mixing, the contents are passed into the frit kiln on the ground floor.

Fritting is still largely done in intermittent kilns resembling a reverberatory furnace. These can be coal or oil-fired. There are in addition rotary fritting kilns fired by gas or fuel oil. Where several different frits are constantly made it is usual to reserve a kiln for one frit, since cleaning a kiln is a lengthy job.

Reverberatory Kilns

The reverberatory kiln (Fig. 1) consists of a shallow hearth built of aluminous firebrick on which the charge is poured through holes in the kiln top. The firebox is separated from the hearth by a bridge wall which prevents direct contact of flame with the frit, and keeps away ashes from the firebox. The heating is by radiation from the flames and the hot bricks of the kiln top. In oil-fired kilns no firebox or bridge wall is required. The hearth bricks are laid together with a wash of china clay and flint, and it is important that they should fit well together, since the joint is the weak spot, which the molten frit penetrates, and which eventually leads to collapse of the kiln floor. Much has been said of the types of refractories most suited for frit kilns. One operator of considerable experience has stated that there is no advantage in buying expensive refractories for this purpose, since it is not the bricks which get eaten away, but the joints, and the final collapse of the hearth is due to this. Potters merchants making, for example, borax frit, normally frit until this happens, running the kiln day and night.

There are various devices to lengthen the hearth life. One of these is to draw cold air through a flue under the hearth. This cools the under sides of the bricks and tends to solidify any frit which tends to leak through. The heated air can be used as secondary air to increase flame temperatures in the kiln.

The size of the charge varies with the kiln. It may be about 30 cwt. for a glaze frit and fritting would occupy about 3-4 hr. During fritting there is considerable gas evolution due to release of air, water of crystallisation, decomposition of carbonates, etc. This is beneficial as it helps to stir up the material thoroughly, indeed some operators still prefer to use borax crystals $Na_2B_4O_7 \cdot 10H_2O$ instead of of the anhydrous material, since, although it requires more heat to melt, the frothing is good for mixing the materials together. Fritting is continued until the material has melted quietly and there is no further gas evolution. A few threads pulled out on the end of a poker are often preserved for record. They should show no trace of gas inclusions or unmelted material. When the test is satisfactory the plug is removed and the molten frit run into cold water to granulate it (Fig 2). This makes it easier to store and also to grind. After running off the tap hole is sealed with a quantity of powdered flint or similar material, and the plug re-inserted. A fresh charge is put on, and the operation continued.

Rotary Kilns

Rotary kilns are fired by fuel oil or by gas. They consist of a steel cylinder lined with a suitable refractory material. They are mounted on a trunnion, which allows them to be tipped for filling and pouring. They can be rotated about a horizontal axis.

After charging they are heated by a burner which is inserted at one end and which fires along the cylinder, the waste gases being collected by a hood over the other end. At first the cylinder is rocked to and fro to assist in mixing the ingredients and to promote melting, and when the material is all molten the cylinder can

Fig. 1. The reverberatory kiln consists of a shallow hearth built of aluminous fire-brick on which the charge is poured through holes in the top

Fig. 2. When tested and found satisfactory the molten frit is run into cold water to granulate

be rotated to complete the process. The charge is tipped into water to granulate it as before.

In the vitreous enamelling trade the tendency is to change to static furnaces of about half-a-ton capacity. These are considered more economic in first cost and running expenses. They are usually oil-fired.

Continuous Fritting

Where a large output of a frit is required it may be advantageous to use a continuous fritting process. One type of kiln for this is shown in Fig. 3. The charge is fed in at the top of kiln and the molten material flows over a series of steps in a shallow stream, which allows gas to escape from it. Finally the frit falls into a water trough from which it is removed.

Reasons for Fritting

Some of the advantages of fritting have been briefly mentioned. It will be appreciated that in covering a ceramic body or a piece of metal with a glaze or enamel it is necessary to get a uniform coating of the unfired material on the ware as a first step to success. Apart from a few special cases such as certain large cast-iron articles which have the dry enamel dusted on the hot casting, the glaze or enamel is normally applied as a slop made with water. Should any of the ingredients be soluble in water, such as borax, soda ash, etc., the solutions of these will either soak into the biscuit or drain off the metal. In either event the result is the same that an essential part of the unfired glaze or enamel is not on the surface of the ware.

Firing in these cases will give poor results.

To remedy this one must either arrange to use alternative materials which are insoluble in water or, if this is impossible, to render them insoluble by fritting. The insolubility is obtained by converting them into complex silicates and borates. Some discretion must be exercised in choosing the materials for a frit so that chemical interaction does not produce a soluble compound.

The second reason for fritting is to get rid of compounds which might cause gas evolution during firing of the glaze or enamel, and thus cause blistering. This is particularly true of enamels, and some of the modern pottery glazes which can be fired up in 3-5 hr. By doing much of the heat work required in the fritting operation it is possible to fire up enamels in 8-10 min., since the process is mainly the melting of what is principally a powdered glass. Fritting is thus seen to be vital to the success of vitreous enamelling where fires of longer duration would almost certainly cause warping of the metal.

For glazes or enamels which are high in plastic clay there is a distinct danger of cracking of the surface in drying. This may lead to crawling in firing. Fritting of a portion of the clay will prevent this fault.

Glazes and Enamels Not All Frit

It is a matter of common experience that glazes and enamels are seldom made up completely of fritted material. This is because such material readily sinks in water and is therefore difficult to apply as an even coating to ware. Moreover it adheres poorly. It is customary therefore to add some clay in the final mixing. This also allows the enameller to control the "set" by coagulating some of the colloidal clay particles with a "set up" agent. It also increases the strength of the unfired enamel, which is advantageous in brushing operations.

Fritting and Solubility of Lead Glazes

Fritting has played an all important part in the introduction of the low-solubility glaze, which has reduced lead poisoning to negligible proportions among pottery employees. In 1897 there were 432 cases reported in this country and 109 in 1904. In 1944 no cases were reported at all.

The alternative of using a leadless glaze was not possible in all cases. In 1893 the Home Secretary appointed a committee to enquire into lead poisoning. This committee reported and recommended the use of lead frits to reduce what was a widespread disease. Very little was done about this report, and five years later in 1898 a further enquiry was held, and Sir Thos. Thorpe published his paper on the use of lead in pottery manufacture.

Realising that the cause of lead poisoning was the dissolution of lead compounds in the gastric juices as a result of lead compounds reaching the stomach through the mouth or nose, he investigated the effect of the composition of lead frits on their solubility, and found, that it varied with the ratio of lead to silica. The least soluble frit was the bisilicate $PbO \cdot 2SiO_2$. He also stated the empirical relationship known as Thorpe's Ratio which stated that for a glaze or frit to be reasonably insoluble in 0·25 per cent. hydrochloric acid, the sum of the molecular parts of bases and alumina expressed as lead oxide PbO divided by the sum of the molecular parts of acidic oxides expressed as silica should be not more than 2, i.e.

$$\frac{\text{Sum of bases} + Al_2O_3}{\text{sum of acids}} \times \frac{223}{60} \quad \text{Not greater than 2}$$

where 223 and 60 are the molecular weights of PbO and SiO_2 respectively. The reason for choosing 0·25 per cent. hydrochloric acid is that this corresponds approximately to the acid content of the stomach, bearing in mind the difference in temperature between the body and the ordinary temperatures at which solubility tests are normally carried out.

Thorpe's ratio breaks down if the frit or glaze is high in B_2O_3 (reckoned as acid oxide in ratio) since lead and borax cannot be fritted together since lead borate is formed which is completely soluble, low solubility glazes are compounded of a lead bisilicate frit, made from red lead and sand, and a borax frit. The latter is made from borax, whiting, china clay, and stone or felspar. Its composition varies. Typically it is

$$\left.\begin{array}{l} 0{\cdot}6\ CaO \\ 0{\cdot}4\ (NaK)_2O \end{array}\right\} \quad 0{\cdot}18 - 0{\cdot}22\ Al_2O_3 \quad \left\{\begin{array}{l} 2{\cdot}0\ SiO_2 \\ 0{\cdot}6 - 0{\cdot}8\ B_2O_3 \end{array}\right.$$

The usual mixing for a low-sol glaze is 25-30 per cent. of bisilicate frit, 40-45 per cent. of borax frit, approx. 30 per cent. of stone and 5-7 per cent. china clay. Sometimes a little flint is added.

Enamel frits are designed to mature at lower temperatures than glazes for pottery. They contain relatively larger amounts of fluxing material and their expansions have to be much higher to accord with that of the metal. Opacifying agents also enter into their composition more frequently than in pottery glazes. Frits may be roughly divided into sheet-iron and cast-iron enamels and also into ground and cover coats. Enamels normally consist mainly of frit with 6-7 per cent. of clay and other mill additions such as opacifier, colouring oxide, etc.

Ground Coats

The ground coat is most important in promoting adhesion of enamel. Usually it contains cobalt oxide and is coloured blue. Sometimes to economise in this expensive compound nickel oxide is added as well.

Exactly how the cobalt promotes adhesion is not definitely established. One view is that crystals of cobalt form on the iron, and penetrate into the ground coat and anchor it to the metal. It has recently been shown by using radioactive cobalt oxide that, in firing, a layer of cobalt forms in the lower layers of the enamel adjacent to the metal.

The composition of a sheet-iron ground coat frit normally lies between 75-85 per cent. of a mixture of quartz, felspar, and borax. The percentage B_2O_3 is between 10 and 30 per cent. and 65 per cent. SiO_2 is about a maximum. Sodium compounds give a percentage Na_2O equal to about 18-22 per cent. and 3-7 per cent. calcium fluoride is usual as an additional flux. A typical ground coat for sheet-iron enamel is ("Vitreous Enamels." Borax Consolidated Ltd., 1949):

Borax	41·0
Felspar	20·5
Quartz	22·8
Soda ash	8·0
Soda nitrate	3·6
Fluorspar	4·1
Cobalt oxide ...	0·3
Nickel oxide ...	1·7
Manganese oxide ...	0·5

On cast-iron the cover coat is usually applied over a grip coat consisting of a mixture of borax, ball clay, quartz and water which is

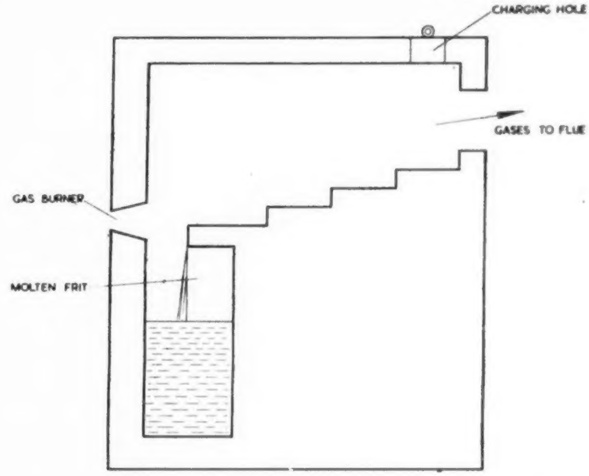


Fig. 3. Diagrammatic sketch showing the continuous fritting process

ground in a mill, and sprayed on. After firing at 830° C. it gives a thin semi-glassy coat which promotes adherence of the cover coat.

Cover Coats

The composition of cover coats offers a wide range giving various different properties, which can be varied by altering the composition. The most important ones are hardness, opacity, glass, acid resistance, and resistance to sudden heating and cooling. It is not usually possible to combine all these desirable properties in one enamel.

In general, cover coats must fuse at temperatures slightly below that of the ground coat, since otherwise the former may boil through the cover coat with disastrous results. At the same time the ground coat must be soft enough to enable a satisfactory bond to be made between the coats.

The composition of cover coats for castings is different from that used on sheet-metal. Since the casting normally takes longer to heat up, the cover coat is made more fusible than usual, and its viscosity when molten is reduced. This is to enable gas given off by the casting to escape through the enamel and to allow the craters to heal over to a smooth coat.

Cover coats used for dusting on large articles, such as baths, are made even more fusible, since they must be melted down by the heat of the casting when withdrawn from the kiln. To achieve this the silica is reduced, and the fluxing materials, e.g., borax increased. Additional fluxes like zinc and barium oxides may also be introduced. Various recipes are given in the reference already quoted, and in other works on vitreous enamelling.

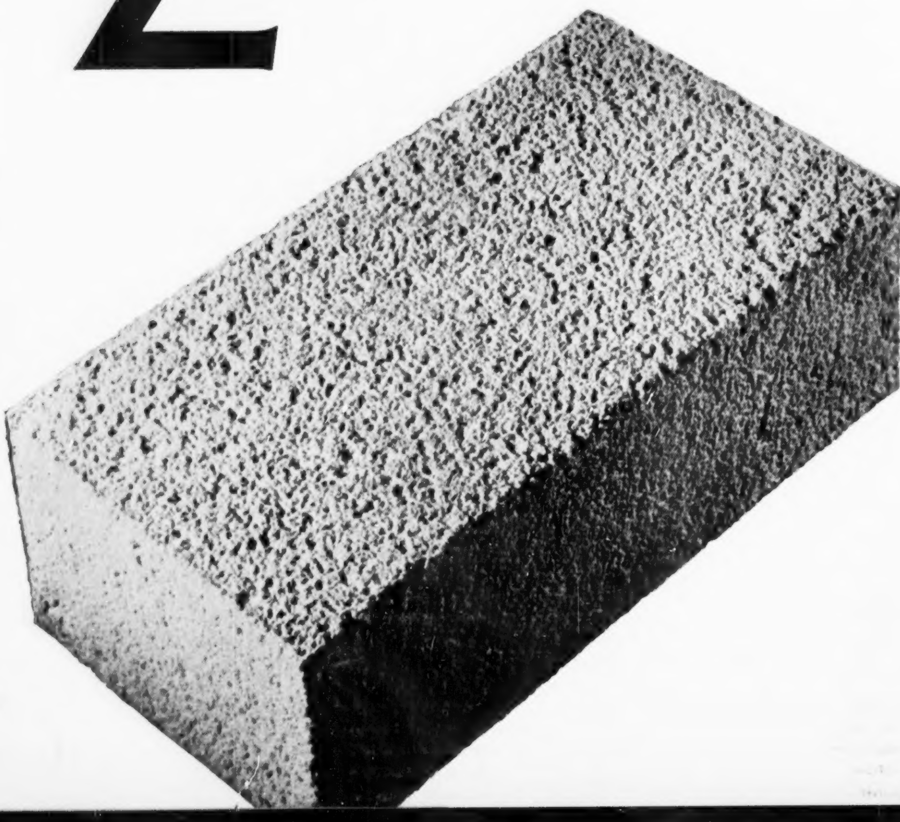
Self-opacifying Frits

Frits containing titania can now be made which, although clear, become opaque on reheating due to crystallisation. They fuse at 780°-820° C., and opacity is so good that it is possible to finish ware with only one cover coat. Such frits are widely used in acid-resisting enamels for cookers, etc. A typical example (op. cit.) is:

Borax	24·5
Quartz	50·2
Pot. nitrate	9·7
Titania	17·25
Zinc oxide	1·0
Cryolite	3·3
Boric acid	4·6
Mag. Carbonate ...	2·1
Pot. Phosphate ...	1·45

These frits are used in enamels which are tending to replace the conventional ones using tin oxide, zirconia, etc., as opacifiers.

Other recent developments are the introduction of lithium compounds to give enamels which mature at lower temperatures, and the development of lead frits which can be used on aluminium.



MATERIALS HANDLING

by

D. H. BRIDGE

(Fisher and Ludlow Ltd., Birmingham)

THE technique of materials handling has been discussed so often in the last few years by so many, that it is extremely difficult not to repeat many of the statements already made. I feel, however, that the more often materials handling is talked about, the more we are reminded of its importance in industry today. I wonder how many of you have realised the relationship between materials handling costs, and the selling price of your products.

Effect on Costs

Materials, direct labour, and materials handling costs are the primary factors concerned, and it is essential that these be kept to a minimum. As these items rise, so it affects the prime cost, the cost of manufacture, the total cost, and finally your selling price.

I can recall a certain Company, not connected with the pottery industry, who were producing a certain component in 28 seconds. This was an accumulation of operational times carried out on special purpose machinery. It was with great satisfaction that they announced that they had speeded up the operation concerned, and were now getting a component finish in 25 seconds, a saving of 3 seconds or approximately 10 per cent. The time spent on materials handling on the original method, was assessed at 16 minutes, and this remained the same on the revised process.

Now this was a case where money spent to re-design special purpose machinery, which only saved 3 seconds per component could have been more wisely spent in reducing the handling costs by a similar percentage, thus saving many man minutes. If a 10 per cent. saving could have been made on materials handling time, it would have saved 1·6 minutes per component.

I mention this example because it was a clear case of management failing to appreciate that materials handling and production must be co-ordinated to respond as a complete unit. This cannot be achieved unless there is someone with knowledge of the whole set up, who is able to see that not only does the handling equipment suit the plant, and the personnel, but that it is worked correctly and is an integral part of the process operation. There has been an appointment of a Materials Handling Engineer by larger Companies, but where this is not possible, it is personnel such as yourselves who could be responsible to see that any materials handling equipment functions correctly, and that the right equipment is installed to meet the production difficulties, of which there are so many in the ceramic industry.

An Attitude of Mind

Good handling is not merely a question of suitable equipment, but it is an attitude of mind, and it is with this attitude we must all educate ourselves to get the best results. There are still many who think that the purchasing of costly and elaborate equipment is going to solve their handling troubles. This is, of course, not always so, as it is equal importance to consider the personnel who are to work in connection with this equipment. Frequently it is more economical to move the workers and the equipment to the product, rather than move the product to the normal location.

I know that many of your existing buildings and layouts do not always

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A lecture given to the British Pottery Managers' and Officials' Association on 2nd March, 1953.

lend themselves to this, as working space is very often confined to awkward shaped buildings and small areas. I trust that some of the examples, given later on, will show you how flow principles have been applied in very confined working areas.

Consideration must be given to the various physical dimensions of the workers. I would like to make a point here about an installation I was recently connected with to illustrate this. A moving belt was in operation at the unloading point of a tunnel kiln. About half-a-dozen operators were unloading saggers from the kiln cars, and placing them on to a belt, where they proceeded on to the next operation point. The height of each operator at the unloading station varied from 4 ft. 10 in. to 5 ft. 11 in. Instead of having the belt at one continuous level, the lower end was fixed at 2 ft. from the floor, with a gradual incline to 2 ft. 10 in. at the opposite end. Now this allowed each operator to load at his own particular level, the shorter operator, of course, working at the lower end of the belt.

It can be said then, that the introduction of the correct handling equipment can reduce fatigue, which, of course, allows increased output and quality from the operators. A tired worker often results in increasing the number of reject components, and tends to reduce the interest in his work.

Handling Equipment and Quality

With regard to handling equipment maintaining the quality of pottery ware, I believe this to be quite true, especially when ware is handled in the ductile condition, I believe you call this the "Green" stage. I was given a figure of 12 per cent. savings in scrap ware, which was being distorted and broken, purely as a result of inter-process transportation. By installing a conveyor belt, which was free from any excessive vibration, it had allowed this increase in output.

What are to be said for the natural resources that are available to the mechanical handling engineer? Perhaps the most obvious of these is gravity.

Although this may be of great use and assistance to a number of industries, I feel I have seen enough of the pottery industry to realise the delicate components such as you make, cannot be allowed to slide down chutes or allowed to travel along the uneven surface of any form of gravity track. I feel, therefore, that ware must be free from any sliding friction, and must be carried on a positive moving surface.

I have no doubts as to what may immediately enter your minds. A moving belt, or perhaps a tray type conveyor, or maybe the conventional type stillards with the widely used work boards. It does not necessarily mean that the purchase of this equipment involves high cost. On the contrary, there are manufacturers of materials handling equipment, who have spent a great deal of type and development work to produce conveyors of unit constructive parts which enable installations to be built of standard components, which, of course, can be produced cheaper than a job that is tailor made. Not only do unitised conveyors cost less, but the component parts can be so interchanged so that as layouts are developed and modified they can be changed accordingly to suit the revised circumstances.

There may be the manufacturer who says to himself, "Am I big enough to go to the expense of installing this equipment?" I would like to reply to that by a story I heard told by a leading industrialist who was speaking at a material handling function. The story goes—of the Father-in-Law who said to his Son-in-Law, "How is it possible for a man in a small Bank to have seven children?" and the Son-in-Law looked at him and said, "Sir, I would have you know that the size of the Bank has nothing to do with this question." So I say to you Gentlemen, that you cannot afford *not* to consider materials handling.

Pre-planning

Considerable progress in the last few years has been made by many firms in the pottery industry, and it is with their help I intend to show you a few examples of flow principles. These installations were not just

put in, with a hope for better results, but were pre-planned. This planning, coupled with personal observations, and knowledge of the industry, ensured economical results.

There is evidence with us today of the present workman, who must do things the same way as his predecessors. I appreciate fully that your industry is a craft, but whether a valuable vase is being produced, or going to the other extreme, a cup as made for "British Railways," whenever this article is handled in its process, something is being added to its cost and nothing to its value. There is also, of course, the risk of breakage or damage.

Management would be well advised to select a single product that is at the moment being produced under existing conditions. Then to trace its movements through the various stages of production, at the same time observing the distance covered, also the number of times it is picked up and down.

I have defined materials handling as the movement of everything within an industrial concern, right from the goods inwards,—the processing—the scrap—the storage—and finally the goods outwards.

From this I have considered three headings:—

1. Transportation from factory to client.
2. Inter-departmental movement.
3. Inter-process handling.

Fork Trucks

With regards to Item 1, which usually involves heavier unit loads, I do not propose to say a great deal tonight, as so much depends upon the geographical location of your works. I would like you, however, to bear in mind the use of the fork lifting truck which has shown very great time and monetary savings in other industries.

There are firms in the ceramic industry, who have applied the fork truck to several of their handling problems, and have experienced high efficiency with this handling method. I know a particular example, where the old method of loading a "goods outwards vehicle" by means of manhandling methods, involved three men plus the driver, which entailed a loading time of 77 min. This was bringing the product from the "goods outwards stores" and loading the transport vehicle accordingly. A fork truck was introduced, and did the same operation in 23 min.

This was quite a large reduction in time. The labour involved was considerably reduced as only the fork truck driver, and a little assistance from the lorry driver was needed.

With regards to Item 2, concerning inter-departmental handling, stillards—spring loaded trucks—platform trucks—and conveyors, are generally the principal types of equipment used in your industry.

Each factory and its output, has to be judged on its own merits, and any of the four mentioned methods can be efficiently used. I am, however, still surprised to see many Companies who still engage labour to carry the ware in boxes or on boards over long distances between departments. These men must walk many miles per day. Each minute a man handles a component the cost of the article increases.

With regards to Item 3, inter-process handling, this is I think the most interesting of all. So much can be done to combine the manufacturing process, with the transportation between operations.

It must be remembered that when an operator, involved in doing specific operations, whether by machine or by hand, has to handle the product or move away from the operation station, production time is being lost.

(*To be continued*)

CANADA DEMANDS QUALITY

An encouraging report of trade opportunities for British goods in Canada, is brought by Mr. E. James Johnson, President of the North Staffordshire Chamber of Commerce and one of the Joint Managing Directors of Johnson Bros. (Hanley) Ltd., earthenware manufacturers, who has recently returned from a business trip to the Dominion and the United States.

Mr. Johnson says that there is still a substantial demand in Canada for quality British goods of all kinds, including pottery. But it was essential that special attention be given to design, because the standard of taste in Canada was, to a large measure, influenced by its geographical nearness to the United States.

Depreciation and Maintenance of Pottery Manufacturing Equipment

6.—Interest on Capital as a Factor In Costs

by S. HOWARD WITHEY, F.Comm.A., etc.

ALTHOUGH British manufacturers are expected to do all they can to limit capital expenditure on new equipment in a determined effort to close the import-export gap and ensure a satisfactory balance in favour of the sterling area, it is inevitable that considerable amounts will have to be expended during the next two or three years for purposes of development, modernisation and re-equipment; consequently, in the computation and recording of the annual sums to be incorporated in pottery manufacturing costings, a vital factor to be taken into consideration is interest on capital expended on fixed and profit-earning assets.

In a case, for example, where the kilns, electrically operated wheels and other pottery-making equipment were shown on the balance sheet at £24,000 as at 31st December last, it was desired to provide for interest on capital at the rate of 4 per cent., this being the rate of interest payable on the money which had been borrowed for the purpose of acquiring the equipment. In consultation with representatives of the suppliers it was decided to write down the book value of the assets in such a way that at the end of another fifteen years' operations the account kept in the firm's private ledger will show a debit balance of £6,000. This meant that in addition to charging a total of £18,000 over the period for depreciation, an amount equal to 4 per cent. of the diminished capital value of the equipment would have to be included in the manufacturing costs. As the annual cost of repairs, overhauls, cleaning and adjustments, etc., was not expected to show any material variation, it was desired to incorporate a fixed figure in the costings for depreciation and maintenance, the precise amount to be written off each year being determined by reference to a specially compiled table giving the decimals required to extinguish £1 over different periods after charging interest at varying rates. This table showed that after debiting interest at the rate of 4 per cent. calculated on each year's reduced book value, the amount of £1,619 would have to be written off at each annual balancing date, this figure being arrived at by multiplying the decimal ·089941 (required to extinguish £1 over 15 years at 4 per cent.—see Table 1)—by £18,000 (the amount to be written off the book value of the equipment)—

TABLE 1
TABLE GIVING DECIMALS REQUIRED TO EXTINGUISH £1 AT VARYING RATES

Years	3%	4%	5%
5	·218355	·224627	·230975
6	·184597	·190761	·197016
7	·160506	·166610	·172820
8	·142456	·148527	·154722
9	·128434	·134493	·140690
10	·117230	·123290	·129505
11	·108077	·114149	·120389
12	·100462	·106552	·112824
13	·094030	·100144	·106456
14	·088526	·094669	·101024
15	·083767	·089941	·096342
16	·079611	·085820	·092270
17	·075953	·082199	·088699
18	·072709	·078993	·085546
19	·069814	·076139	·082745
20	·067216	·073582	·080243
21	·064872	·071280	·077996
22	·062747	·069199	·075971
23	·060814	·067309	·074137
24	·059047	·065587	·072471
25	·057428	·064012	·070952

The amount to be written off is consequently being apportioned over the period in the manner indicated in Table 2.

TABLE 2

Year	Amount to be extinguished £	Interest at 4% £	Total debit £	Amount written off £	Carried forward £
1953	18,000	720	18,720	1,619	17,101
1954	17,101	684	17,785	1,619	16,166
1955	16,166	647	16,813	1,619	15,194
1956	15,194	608	15,802	1,619	14,183
1957	14,183	567	14,750	1,619	13,131
1958	13,131	526	13,657	1,619	12,038
1959	12,038	482	12,520	1,619	10,901
1960	10,901	436	11,336	1,619	9,717
1961	9,717	389	10,106	1,619	8,987
1962	8,487	340	8,827	1,619	7,208
1963	7,208	288	7,496	1,619	5,877
1964	5,877	235	6,112	1,619	4,493
1965	4,493	180	4,673	1,619	3,054
1966	3,054	122	3,176	1,619	1,557
1967	1,557	62	1,619	1,619	Nil

Assuming that no further capital expenditure is incurred during the nominated period, the asset account in the firm's private ledger will eventually show the following entries:

PRIVATE LEDGER

Debit — *Productive Equipment Account* — *Credit*

		£			£
1953			1953		
Jan.	To Balance brought down	24,000	Dec.	By Depreciation written off	1,619
Dec.	To Interest	720	Dec.	By Balance carried down ...	23,101
		£24,720			£24,720
1954			1954		
Jan.	To Balance brought down	23,101	Dec.	By Depreciation written off	1,619
Dec.	To Interest	684	Dec.	By Balance carried down ...	22,166
		£23,785			£23,785
1955			1955		
Jan.	To Balance brought down	22,166	Dec.	By Depreciation written off	1,619
Dec.	To Interest	647	Dec.	By Balance carried down ...	21,194
		£22,813			£22,813
1956			1956		
Jan.	To Balance brought down	21,194	Dec.	By Depreciation written off	1,619
Dec.	To Interest	608	Dec.	By Balance carried down ...	20,183
		£21,802			£21,802
1957			1957		
Jan.	To Balance brought down	20,183	Dec.	By Depreciation written off	1,619
Dec.	To Interest	567	Dec.	By Balance carried down ...	19,131
		£20,750			£20,750
1958			1958		
Jan.	To Balance brought down	19,131	Dec.	By Depreciation written off	1,619
Dec.	To Interest	526	Dec.	By Balance carried down ...	18,038
		£19,657			£19,657

1959		£	1959		£
Jan.	To Balance brought down	18,038	Dec.	By Depreciation written off	1,619
Dec.	To Interest	482	Dec.	By Balance carried down ...	16,901
		£18,520			£18,520

1960		£	1960		£
Jan.	To Balance brought down	16,901	Dec.	By Depreciation written off	1,619
Dec.	To Interest	436	Dec.	By Balance carried down ...	15,718
		£17,337			£17,337

1961		£	1961		£
Jan.	To Balance brought down	15,718	Dec.	By Depreciation written off	1,619
Dec.	To Interest	389	Dec.	By Balance carried down ...	14,488
		£16,107			£16,107

1962		£	1962		£
Jan.	To Balance brought down	14,488	Dec.	By Depreciation written off	1,619
Dec.	To Interest	340	Dec.	By Balance carried down ...	13,209
		£14,828			14,828

1963		£	1963		£
Jan.	To Balance brought down	13,209	Dec.	By Depreciation written off	1,619
Dec.	To Interest	288	Dec.	By Balance carried down ...	11,878
		£13,497			£13,497

1964			1964		£
Jan.	To Balance brought down	11,878	Dec.	By Depreciation written off	1,619
Dec.	To Interest	235	Dec.	By Balance carried down ...	10,494
		£12,113			£12,113

1965		£	1965		£
Jan.	To Balance brought down	10,494	Dec.	By Depreciation written off	1,619
Dec.	To Interest	180	Dec.	By Balance carried down ...	9,055
		£10,674			£10,674

1966		£	1966		£
Jan.	To Balance brought down	9,055	Dec.	By Depreciation written off	1,619
Dec.	To Interest	121	Dec.	By Balance carried down ...	7,557
		£9,176			£9,176

1967		£	1967		£
Jan.	To Balance brought down	7,557	Dec.	By Depreciation written off	1,619
Dec.	To Interest	62	Dec.	By Balance carried down ...	6,000
		£7,619			£7,619
		£			
Jan.	To Balance brought down	6,000			

The items of annual interest debited to the private ledger account will be posted direct to the credit side of a reserve account for the replacement of equipment. The next article in this series will include examples demonstrating methods of creating reserves and reserve funds.

High Pressures in the Production of Ceramic Tiles and Slabs

Russian Experiments

ACCORDING to Prof. G. V. Kukolev and co-workers the usual pressure for the production of floor tiles in different type presses is 250/260 kg./cm.^{2}, with material of 8-9 per cent. moisture content (m.c.). This appears to be about the limit used abroad. But recently in Russia different workers have suggested higher pressures. A. Panarin and G. Tazitdinov (*Proc. 2nd* Conf. on Refractories—U.S.S.R., 1941) found, on increasing pressure from 200 to 1,000 kg./cm.^{2}, a marked increase in compression strength, with higher density (vol-wt.) and lowered porosity, for chrome-magnesite bricks. A. Berezhnoi (*Ogneupor.* 1947, No. 3) referred to the close relation between pressure and true porosity; and later (*ibid.* 1948, No. 8), with pressures up to 1,500 kg./cm.^{2}, he confirmed that, with magnesite blocks, there was much more sintering in the firing process. S. M. Beluga and A. F. Zolotorog (*Steklo i Keram.* 1950, No. 8) studied the effect of pressure, grain size, and moisture content, on shrinkage (compression) of ceramic slab. With increase from 100 to 300 kg./cm.^{2} dimensional changes and water absorption of the fired products were reduced.

Need for Further Study

This brief review seemed to indicate the need for further study of pressure effect on density and strength. Some experiments were accordingly undertaken by the author and co-workers in the Dept. of Ceramics, Glass, Refractories, etc., of the Kharkov Polytechnic, in collaboration with one of the brick and ceramic factories there, results of which are here recorded. (*Steklo i Keram.* 1952, **9** (10), 8-10.) The material used was clay from the Nikolaevsk formations in the Don coalfield area, commonly used in the brick and tile works. The finely powdered material (through 0·5 mm. sieve) of 3 to 9 per cent. moisture content, and under pressures of 100 to 1,000 kg./cm.^{2} was formed into blocks in the lab. hydraulic press of 75 by 35 mm. Density was determined by calculation of ratio of height of mass fed into thickness of block. Strength was measured by bending tests on some samples from each series after drying at 110° C. The dried slabs were fired in the laboratory furnace at temperatures between 1,100° and 1,200°, except some that were fired in the tunnel furnace of the Kharkov brickworks at 1,180°. Extent of clinkering was determined by water absorption tests. Results are shown in several tables and graphs.

Summary of Results

From the first table (densities) it is evident that a pressure of 250 kg./cm.^{2} for samples of 8-9 per cent. m.c. is by no means the optimum limit. There is a fairly steady increase in density—from 1·55 to 1·96—in the pressure range 100 to 1,000, m.c. being 3 per cent.; and from 1·79 to 2·12 with m.c. of 9 per cent. In the second table are shown bending strengths: with increases from 4·5 to 21·3 kg./cm.^{2} (through same pressure range) for 3 per cent. m.c., and from 7·2 to 33·3 with m.c. of 9 per cent. Again is shown a fairly uniform increase with m.c. and pressure. Water absorption (Table 3) declines from 9 per cent. with m.c. of 3 per cent. to nil with m.c. of 9 per cent. Here also there is practically linear increase of sintering with pressure,

irrespective of initial m.c. (firing temperature, 1,180°). A further table shows water absorption for material of m.c. 8 per cent. in the pressure range 100 to 600 kg., and firing temperatures of 1,100°, 1,130° 1,160°, 1,180° and 1,200°. At minimum temperature and pressure (1,100° and 100 kg.), with density of 1·76, water absorption is 9 per cent., declining to 0·3 per cent. with pressure of 600 kg. and temperature 1,200° (density 2·04). The table also shows that, under the usual pressure of 250 kg. a temperature of 1,180° is required to reduce water-absorption to about 2 per cent.; but with pressure raised to 500 kg./cm.² a temperature of 1,130° is sufficient.

Tests under factory conditions with the Krasnie (Red) hydro-press and toggle hydraulic-press gave results in full agreement with those of the laboratory, and are tabulated as follows:

	Pressures 500-600 kg./cm.² and m.c. 3·7%		*Pressures 250-300 kg./cm.² and m.c. 8%*	
	Hydraulic	*Toggle*	*Hydraulic*	*Toggle*
Height of material in mould (mm.) ...	22	23	22	23
Thickness after pressing, average in mm.	11·8	11·8	11·7	11·5
Average density	1·89	1·98	1·98	2·0
Water absorption after firing: per cent.	2·1	2·0	2·0	1.9

Thus, by raising pressure to 500-600 kg./cm.² m.c. may be reduced to 3·7 per cent. to give comparable results, so that much less drying is required before firing. Or, with a given m.c., temperature of firing may be lowered by 40°-50°, with improved quality of product, e.g., with little or no deformation and unsightly marks. In this way the range of possible raw material or clays may be extended.

Manufacture of Domestic Pottery in China and Earthenware Clays

The use of Towns Gas

by

K. DAVIES

THE making of articles from clay is one of the oldest of human crafts, dating back to prehistoric times when no doubt men first observed that the plastic properties of clay were changed when dried by the heat of the sun or fire, and became hard, thus making vessels suitable for use in everyday life.

A Wide Field

Modern ceramic art covers a very wide field indeed, and includes the manufacture of all types of domestic and art pottery, bricks and tiles for building and decorating purposes, sanitary and sewage ware, refractories, products for the chemical industry and insulators for all sections of the electrical industry. All these products are made in the potteries, and towns gas is playing a leading part in the manufacture of them all. However, the subject matter of one single process, in the manufacture of one particular article, is sufficient for a number of papers, and this paper, therefore, is confined to the use of towns gas in the manufacture of pottery in the earthenware and bone china clays and for the most part the subject is only lightly touched upon.

Earthenware clay is used for the manufacture of domestic and art pottery, wall tiles, and sanitary ware.

The term earthenware is given to a mixture of ball clay, china clay, flint and stone with the addition of a cobalt stain which is added to whiten the clay in the same way that household blue whitens the clothes on washday.

Ball clay gives plasticity to the body and strengthens it after drying, china clay gives whiteness, and flint opens the body and allows even expansion during firing. Stone is a flux giving vitrification, hardness and strength after firing.

These materials are first ground very finely either in the dry state or in water. The flint is first calcined to enable the material to be more easily ground.

If the materials are ground in water we now have separate slips of each ingredient, and a proportion of each of these slips are mixed together in a mixing ark to provide earthenware clay slip.

If ground dry, the materials would be weighed and mixed in the dry state and then formed into earthenware clay slip by the addition of water.

This earthenware slip is now passed through vibrating screens to remove coarse particles, through electromagnets which remove particles of iron, and then to a filter press to remove surplus water.

The filter press comprises of recessed frames of wood or iron with filter cloths between each frame, thus forming a series of separate chambers. The slip is pumped into these chambers and the press is screwed up. The pressure forces out the water and leaves behind plastic cakes of earthenware clay. These cakes now pass through a pug mill and de-airing machine which extrudes the clay as a homogeneous mass free from air pockets and ready for the maker.

A paper presented to the Midland Junior Gas Association at Birmingham on Tuesday, 16th December, 1952.

There are four main methods of shaping the clay or slip into articles. They are throwing, pressing, jollying and casting.

Throwing is nowadays only used to obtain special shapes, and the three other methods are mainly employed. Pressing is used almost entirely in the manufacture of wall tiles and electrical porcelain.

The plastic clay from the filter press has a water content of approximately 30 per cent. and for pressing purposes this has to be reduced to about 7 per cent. by a gas-fired dryer. These dryers may range in design from an ordinary brick-built stove where the plastic cakes of clay are placed on racks with rails of neat jet burners positioned around the base of the stove, through numerous types of dryer employing recirculated hot air supplied from direct heated gas-fired air heaters, to the continuous dryer where the plastic clay is extruded into thin sheets on to a stainless steel belt and conveyed through a tunnel using natural draught or air-blast burners and hot air recirculating fans. One of these dryers will deal with approximately 1 ton of clay per hour and has a gas rate in the region of 1,400 c. ft. per hr.

After drying, the clay is disintegrated into a fine powder and the articles are die pressed from this powder.

Jolleyed ware is made from plastic clay on a revolving plaster-of-paris mould. A pancake of clay is placed on the mould and the article is shaped by a former while the mould is revolving.

Some articles, particularly hollow-ware are made by casting them in plaster moulds, and this method employs the earthenware clay in the form of a dense slip. This slip is prepared from the plastic clay by adding a little water together with a deflocculent. This is an alkali which renders the clay fluid without the addition of excessive water and gives a dense clay slip. This dense slip is poured into the mould and allowed to stand for about 20 min. and then poured out. A casting of clay of suitable thickness is left adhering to the inside of the mould which is now parted and the casting removed.

Articles which have been formed by any of the foregoing methods that is, throwing, jolleying or casting, together with the plaster moulds, must now be dried, and it is in these drying operations that towns gas begins to play an ever increasing part in the process of the manufacture of clay goods. Drying used to be carried out on racks in rooms heated by steam coils or stove pots and it would usually take 24 hr. or even longer before drying had occurred to a sufficient extent to release the clay article from the mould. Excessive handling of the fragile clay goods, coupled with the fact that clayware will often crack if subjected to temperatures above 80° C., and that plaster moulds are seriously damaged by temperatures in excess of 70° C. causes serious loss in moulds and wastage of labour in remaking damaged articles. Moreover, these methods of prolonged drying meant that large numbers of moulds were required in circulation for a given daily output of each particular piece of ware.

Towns gas with its ease of control of both temperature and humidity is an ideal fuel for these drying operations and the present shortage of gas in the Potteries Area is the only curb to the installation of a large number of dryers for this purpose.

During drying the interior of the clay must be kept at as close a temperature to that of the outer surface of the clay as possible, otherwise skin drying would result in unequal shrinkage and build up of internal vapour pressure in the clay which would cause cracking. These cracks are sometimes so fine that they only show up in later stages of firing when the articles would be completely useless and serious loss could occur. Humidity in dryers is, therefore, very important and the usual practice is to subject the ware to warm air in which the humidity is slowly reduced while the temperature is kept constant. In tunnel dryers, warm air which is usually supplied as waste hot air from the cooling end of the biscuit or glost firing tunnel kiln, is introduced into the exit end of the tunnel dryer and moves in a contra flow to the direction of the ware, towards the entrance thus increasing in humidity as it passes through the drying clay

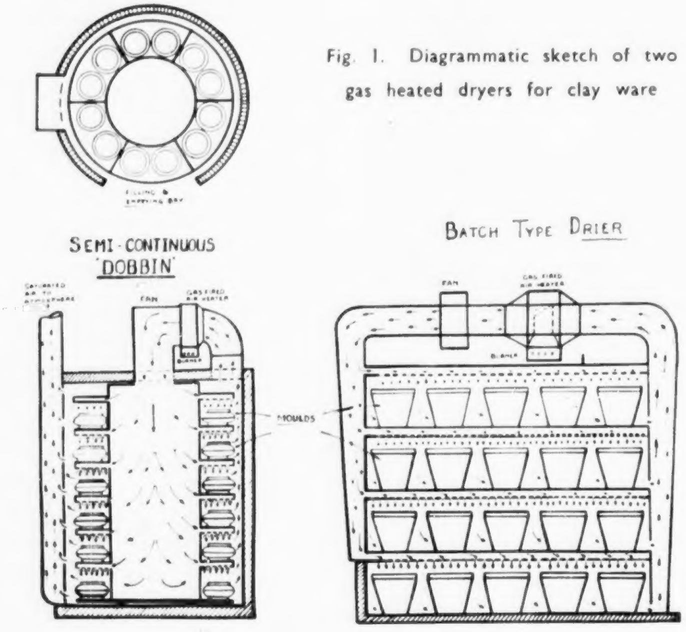


Fig. 1. Diagrammatic sketch of two gas heated dryers for clay ware

goods. In the modern factory the making shops are sited close to the tunnel ovens with the express purpose of utilisation of waste heat from the tunnels for drying.

Gas-heated dryers for clayware are numerous in design, but perhaps the most popular type is the semi-continuous stove known as a dobbin. In this dryer hot air is provided by a direct gas-fired air-heater, and jets of hot air are directed on to the mould holding the clay article and then recirculated. Provision is made for the intake of fresh air into the system and for a controlled quantity of saturated air to be discharged from the dryer to atmosphere. Fig. 1 shows a diagrammatical sketch of two such driers, one of which is semi-continuous for drying plates and saucers on plaster moulds, and the other a batch type dryer used for drying heavy mould used for casting large hollow-ware articles.

The air-heater comprises of from one to three rows of industrial jets positioned so that each burner will ignite from its neighbour. The burner is protected from flame failure by a solenoid-operated gas valve held open by a thermocouple positioned in the pilot burner flame. Products of combustion from the burner together with danger controlled fresh air, are drawn into the recirculating system by the recirculating fan and the temperature of the air entering the dryer is controlled by a thermostat positioned in the air stream and operating a relay valve on the gas line. An electrically maintained gas valve is wired to the electricity supply to the fan ensuring that gas only passes to the burner when the fan is running.

Fig. 2 shows a photograph of a circular dobbin drying flat ware on plaster moulds. The newly made clayware is being placed on shelves on the left of the opening while dried clayware and moulds are being taken out from the other side. The dried moulds are of course ready for re-use by the maker immediately after the dried clay article has been removed. This dryer will deal with 360 5 in. plates or saucers complete

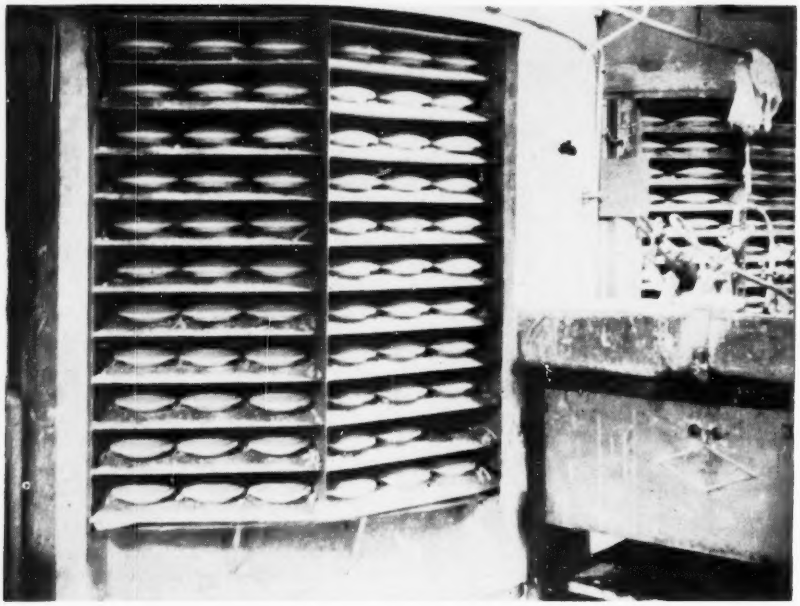


Fig. 2. A circular dobbin drying flat ware on plaster moulds

with their moulds per hour and time taken for an article to pass through the dryer is 1½ hr. This compared with 10 hr. or longer in the old type coke-heated stove gives some idea of the amount of moulds saved by the gas-heated dryer which is entirely automatic and fool proof in its operation, only requiring the operation of a switch to put it into or out of operation at any time. The gas rate is 250 c. ft. per hr., giving 1·44 plates and moulds dried per c. ft. of gas used.

Bone china clay is used for the manufacture of domestic pottery and art goods, figures, vases, brooches, etc., and is a mixture of china clay, bone ash and stone. The bone ash is obtained by calcining the bones of oxen, and some of this calcination is carried out in the Potteries in gas-fired furnaces. The bone ash gives translucency to the china body, acts as a powerful flux during firing, and with the stone, gives hardness and strength after firing. The china clay gives whiteness to the body and the combination of these materials results in an intensely white cold translucent article easily distinguishable from that of earthenware.

The method and preparation of bone china plastic body and casting slip, and the methods of shaping ware are similar to that of earthenware, but the absence of plasticity due to the absence of ball clay results in a "lean" body which although dried easily, is much more fragile than earthenware and requires very delicate handling in the clay or green state.

After drying, both earthenware and bone china clay articles are sponged and fettled to remove rough edges, the feet of cups, etc., are turned out on a lathe, handles are stuck on and after further drying are passed to the place for the first firing.

(to be continued.)

British Ceramic Service Co. Ltd.—It is announced by this company from their address at Bricesco House, 1 Park Avenue, Wolstanton, Stoke-on-Trent, that they have opened a department for the supply of ceramic materials to the studio potter.

Modern Trends in Structural Clay Products

THE present tendencies in clay products for construction are dictated by two main considerations:

(a) to reduce the cost.

(b) to save raw materials in short supply.

In connection with the former the emphasis is on reducing labour charges, and means must therefore be devised of enabling a worker to erect more wall or floor area in the same working time. This involves using machinery to cut out where possible the slow and expensive man-handling of materials, and in developing a larger type of brick of such a weight that a man can handle it comfortably.

Under the second heading of conserving materials in short supply must be considered saving of steel and wood normally used in construction. This should be done with a view to reducing costs at the same time. The lines of approach to this problem are to reduce the weights to be supported on beams and girders by the use of lightweight building materials. The beam and girder sizes can then be reduced. At the same time the use of lightweight materials will probably also improve insulation both for heat and sound. Under this heading can be considered lightweight aggregates made from clay itself, as well as from other sources.

Hollow Blocks

One way of increasing the size of the building unit and thus the volume of building that can be done per day is by using a hollow block or perforated brick. These are widely used on the Continent and in the U.S.A., being extruded and wire cut. Various shapes are made, but all have a strength adequate to the purpose.

Extracts from a lecture given by W. L. German, M.Sc., Ph.D., F.R.I.C., to the Stoke-on-Trent Branch of the Institute of Clay Technology, February, 1953.

We tend to frown rather on hollow bricks in this country and in this part of the world, and some of this prejudice must be laid at the doors of local authorities. In some parts of Britain perforated bricks have been used for a long time, and so have hollow concrete blocks. The former are easier to dry and fire than the heavy solid lumps of clay which are made in most parts of the country.

The use of large hollow blocks of various designs on the Continent, which are easily handled, means that walls can go up at a great speed, and the durable clay surface can be either rendered down or colour washed. Blocks about 6 in. by 9 in. by 12 in. are not uncommon overseas. The use of hollow blocks for partition walls and floors (with suitable reinforcing) has been known for some time in this country but their use for outer walls has not been widely adopted.

Lightweight Materials

Hollow blocks are usually filled with concrete. In order to reduce the weight on floor joists, and thus to save timber or steel, increasing attention is now being paid to lightweight materials. These are usually made up from a lightweight grog bonded with either clay and fired, or with cement.

Thus it has been known for some time that certain types of clays can be bloated if fired incorrectly. If the fire is hurried in the oxidation period the clay may vitrify on the outside before all the carbon has been burnt out or before decomposition of sulphides, carbonates, etc., has occurred. This gas evolution results in bloating, when the clay may be blown up considerably. In recent years in U.S.A. bloating has been deliberately encouraged in order to make a lightweight aggregate. The clay must of course fuse sufficiently to fill the pores with a molten material sufficiently viscous to prevent escape of gas, and some

material must be present to generate this. The temperature at which this happens must not be too high.

C. M. Riley (J. Amer. Ceram. Soc. **34.** 121. 1951—cf. British Clayworker **60.** 78; 105. 1951) has studied the bloating of clays and given the range of composition where the conditions for bloating at temperatures below 2,400° F. are fulfilled. As gas generators he lists pyrites, hæmatite, and dolomite.

The dolomite does not simply dissociate but probably reacts with other ingredients of the mass first. Clays which did not bloat could be made to do so by adding silica and alumina to bring them into the composition range for bloating. Igneous rocks whose compositions fell within the composition range for bloating of clays were also shown to bloat on heating after grinding and making into briquettes. This suggested that such materials as rhyolites, trachytes and dacites would be worth investigating as lightweight aggregates. In the manufacture of expanded clays the material is quickly heated in a rotating furnace so as to bloat the clay and deliver a continuous stream of material which can then be graded.

When it comes to making lightweight clay products it may be more convenient to make a lightweight article by including some combustible material like sawdust or coal dust with the clay, and then burn it out in the firing. Obviously this will require care, but when properly done, a brick of half the weight can be obtained. Such material is very useful for sound and heat insulation.

Expanded Clay in Clay Blocks

The use of lightweight aggregate made from expanded clay as a grog in ordinary clay has been described. The aggregate was made by making pellets of clay and coke dust (about 10 per cent.) and sintering them. These were ground to pass a No. 3 mesh sieve. The clay and aggregate were mixed in varying proportions, e.g., one, two and three parts of aggregate to one of clay (by weight) and tempered with water. The blocks were then formed by hydraulic pressure, and fired in a tunnel kiln.

The same method was used to form blocks with mixtures of clay with additions of up to 10 per cent. of sawdust, shaving, etc. It is claimed that use of aggregate in blocks reduces the shrinkage and warpage, and enables blocks to be made lighter and to closer tolerances. Further, they are easier to break and cut during building operations.

Hollow Blocks in Roof Construction

It is not only in wall construction that structural clay products are coming to the fore. The shortage of steel roof trusses has encouraged the use on the Continent of hollow blocks for roof construction. These are comparatively light in weight and are assembled on templates on the ground. Reinforcing rods are grouted into them and when the concrete has set the beam is hoisted into position. The space between the beams is then filled with concrete, or alternatively with ordinary rectangular hollow blocks and concrete. When set, steel tie beams are tightened to take some of the stress off the supporting piers. The scaffolding is then removed. Such a concrete roof is much lighter than a reinforced concrete one since it contains a fairly large void space. The result is that less shuttering is required, and what is used is of a simpler nature. This reduces the cost materially. The roof can be covered with all the usual coverings, including tiles.

Other Mineral Products for Lightweight Grog

Mention should also be made of materials like exfoliated vermiculite—a mineral of the mica family. On heating to about 2,000° F. this expands from nine to sixteen times its original volume due to expulsion of steam and the product weighs only 7-10 lb./c. ft. depending on the grade. Used in concrete and plaster this reduces the weight by about two-thirds.

Foamed blast furnace slag is another material which is light and has a high insulating value. It is obtained by treating blast furnace slag with water in the correct amounts. The steam expands the molten slag. A glassy volcanic rock—perlite can also be expanded by heating, giving a lightweight aggregate useful for bonding with clays for insulating lightweight bricks.

Clay is still a very versatile material for constructional purposes, and research is constantly going on to extend its applications. Its ability to compete with other types of material will very largely depend on the vigour with which this is prosecuted.

SHELLAC TREATMENT FOR EARTHENWARE

EVOLVED by the Indian Lac Research Institute at Namkum, near Ranchi, in the State of Bihar, a new process of treating and repairing earthenware vessels with shellac will, it is claimed, render them impervious to water and proof against fermenting bacteria. It is also claimed that, as well as being given a brighter appearance, the earthen pots used by the teeming villagers in India as cooking and storing utensils, will be made resistant to the action of hot water, common salt and oils. Because of the lower costs it is thought that earthenware pots treated in this way might be able to compete with utensils made of stone, porcelain or glass.

To prepare the varnish good quality shellac, free from impurities, is soaked in liquor ammonia of the requisite specific gravity and left overnight in an enamelled or tin-plated vessel. The following day the solution is heated for about six hours, allowed to cool and strained through a fine cotton cloth.

Correspondence

GERMAN BEER STEINS

SIRS,—A friend of ours in the United States has written to us as follows:

"We have a fairly large collection of imported German beer steins and are endeavouring to add to it wherever possible. We shall be glad to learn if there are any books printed that describe the origin, date of manufacture and other information that a collector would like to know from the code marks imprinted on the bottom of the stein."

Is there any publication available from which the above information could be extracted.

We look forward to news in this matter with interest.

C. E. S.

Pyrometer Maintenance

(SPECIALLY CONTRIBUTED)

ONE of the most widely used temperature measuring instruments is the industrial pyrometer, either in its mechanical form as a dial thermometer gauge or as a mechanical recorder, or more often in its more elaborate electrical form using thermocouples. The proper maintenance of each of these types requires regular periodical inspection, frequent testing and repair in order to achieve maximum and correct use.

Some applications of pyrometers demand very close measurement because otherwise either fuel might be wasted, heat treatment might be less efficient, or both together would lower plant efficiency.

Two things, therefore, require attention. First, a proper scheme for preventive maintenance has to be worked out and, second, a man has to be assigned the job to perform maintenance. Where no skilled instrument fitter is available in a workshop there will nearly always be a semi-skilled mechanic or an electrician who can be trained to perform maintenance and even minor repairs on the spot.

Fixing and maintenance instructions are always supplied by the manufacturer with a new pyrometer. They should be carefully filed away but kept handy so that they can be easily consulted in case of need. A good understanding of pyrometers can also sometimes be obtained from makers' literature, and from instrument textbooks.

Trouble tracing on mechanical pressure thermometers and mechanical pyrometers having either a bi-metallic melix or a graphite or metallic expansion rod actuating the mechanism is a comparatively simple matter. By means of comparative tests with a precision instrument any deviations can be detected and usually put right on the spot. Experience is, however, necessary to foretell whether the trouble is in the instrument itself, or rather has been caused by unfavourable working conditions, causing mechanical damage from mechanical shock, vibration, excess temperatures, corrosive fumes or other conditions.

Electric Pyrometers

Equipment for checking may consist of (a) a portable potentiometer instrument, (b) a standard platinum or base metal thermocouple, (c) an electric muffle furnace, (d) a battery box. For most checking purposes the high resistance millivoltmeter will be satisfactory. Sometimes a metal bath is used in place of a furnace for checking thermocouples. It is also possible to carry out the check on fixed installations. Times of regular checking may vary from once a week to once every three months.

Defects in thermocouples are easy to detect, and the hot end reaction is

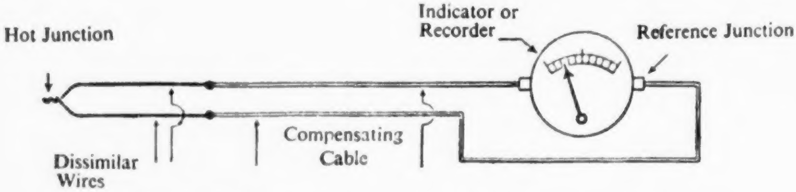


Fig. 1. Extension Leads or Compensating Cables for electric Pyrometer

the first item to check on a test instrument. As the thermocouple deteriorates with age, its e.m.f. falls off, and this should be tested against standard. Always make sure that the thermocouple is properly immersed, as intended by the manufacturer, but avoid excess temperatures. A loose hot junction must be welded together after twisting, and loose or dirty wire connections tightened and cleaned (Fig. 1).

Lead troubles can originate from grounds, and can be detected by disconnecting the instrument, using a magneto set. Plus and minus wires of extension leads must be connected to the respective terminals of the thermocouple, and they are not interchangeable against other leads. All joints should be soldered, and wires kept away from high potential lines, from steam pipes, vibration points, or from danger of mechanical damage.

Most potentiometer pyrometers are working prolonged day and night periods, causing heavy wear and tear. Frequent cleaning and lubricating of the small moving parts, and using the proper instrument oil is most important. Often the galvanometer instrument needs adjustment if out of

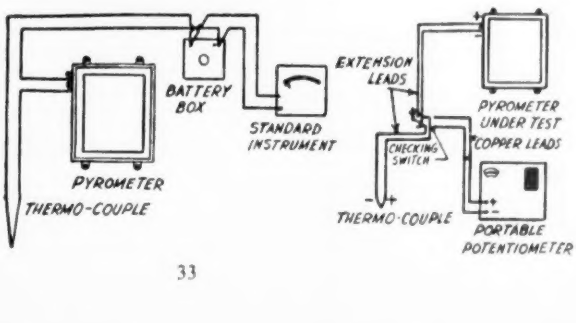


Fig. 2. Checking a Recording Thermocouple Instrument

mechanical or electrical balance. Vibration, a dusty atmosphere, a leaky instrument housing allowing dust to get inside are common causes of trouble. To overdamp a galvanometer by tightening screws or in other ways preventing vibration of the pointer makes the instrument less responsive. The wider use of rubber-to-metal bonded mountings is the best way, apart from relocation of the instrument case, to deal with vibration troubles.

Dry cells used for producing a constant potential must be kept clean and dry. Potentiometer controllers use a mechanical section for producing control movement, and this mechanism positions mercury switches or makes the breaks contacts, which all require proper care. Oxidation of mercury in a vacuum switch tube, and dirty metallic contact surfaces require repair or replacement.

Millivolt Pyrometers

It is important to check millivolt instruments at regular intervals regarding pointer motion by opening and closing the circuit several times. The pointer should then always come to rest at the cold junction temperature. A battery test will reveal whether the galvanometer is in order.

The rotating movement of a galvanometer coil is caused by interaction between two magnetic fields, one being the permanent magnet and the other caused by flow of current in the galvanometer coil. These two fields will try to align themselves so that they are a parallel, with an opposing spring in case a two-pivot mounting is used. The latter provides a sufficient stable and robust instrument. A uni-pivot system, however, in which the pivot is at the centre of the coil, and the movement is balanced so that the centre of gravity of the whole moving system is at the point of the pivot requires greatest care for exact level mounting of the instrument.

A wiring diagram using a simple battery box and a standard instrument for checking purposes is illustrated in Fig. 2. The millivoltage obtained from the temperature e.m.f. curve forces the current through thermocouple and lead wire before it gets to the instrument. This reduces the effective e.m.f. which is applied to the instrument, as in actual operation. By using a double pole double throw switch, when checking under actual operating conditions, the thermocouple e.m.f. can be diverted from the tested instrument and the readings may be compared. The switch should be located as close to the working instrument as possible.

Trouble might also be caused in the external thermocouple circuit, and close examination of the protecting tube and the wiring is necessary. Any leakage in the sheath might cause a breakdown of measurement and falsification of result can be caused by solid deposits. Contaminated furnace atmospheres can cause quick deterioration of a thermocouple well, or they may sometimes penetrate and destroy the hot junction. Temperature tests in the laboratory should always exactly duplicate actual working conditions. The thermocouple head should not be closed too tightly; air should be present around the couple.

Lead wires may also cause trouble, especially when their insulation gives way, owing to moisture or excessive heat. Badly soldered joints and wrong wire installation have to be put right. Thermocouple switches, especially of the rotary type, require regular inspection. Noble metal contacts should be cleaned with smooth hard paper, but not with abrasives.

Correct Installation

Many troubles can be avoided in practice if pyrometers are correctly installed. The great variety of instrument types, of thermocouple heads, of length of stem, of different sheath materials for protection of the hot junction make each installation an individual job. Certain general rulings are, however, easy to observe, and some have already been mentioned.

In determining the correct type of instrument to be used for temperature measurement, precise knowledge is necessary of the information required, the temperature measurements that are essential, and those that are non-essential but of value for the interpretation of the results. Conditions of heat flow through the plant should be carefully surveyed, and it should be kept in mind the sources of error these conditions may introduce.

Sources of error in the temperature measurements themselves and in other determinations, e.g., weights and chemical analyses, will influence the accuracy aimed at in the temperature measurements.

Obviously, temperatures which can alter only slowly will require less frequent readings than those which can fluctuate rapidly, so that operators will consider the frequency of the readings required for each position, having regard to the nature of the process under test and the time variations likely to occur. Procedure will be determined largely by the number of persons available to reading indicating instruments and whether use is made of recording instruments.

Selection of the type of instrument most appropriate to each determination should be governed not only by considerations of accuracy and convenience. Special conditions such as the presence of liquid or gaseous corrosives, the possibility of chemical reactions, the effect of catalytic phenomena on the measuring devices, and similar effects should influence the selection.

Whereas it may be inconvenient to measure the temperature exactly at a point where it is required for the purpose of a thermal balance, another point nearby may be more accessible or permit a higher degree of accuracy thus enabling the temperature at the required point to be computed without difficulty. Therefore it will be necessary to give weight to such factors as ease of access and the degree of accuracy available at a given point in locating the instruments.

An accuracy check of the instruments is, in many cases, extremely important, and thought should be given to the method of checking before, during and after the test.

New Factory Premises.—The White-Rock Quarry Co. Ltd., of Glasgow, has now secured new factory premises at Baillieston, near Glasgow. The company has now self contained and modern facilities and are working from the address, White-Rock Quarry Co. Ltd., Commonhead Road, Baillieston. Tel.: Baillieston 1145. The managing director is Mr. W. W. Gault.

HAZARDS OF HEAVY LIFTING

LIFTING heavy loads is part of the routine job for workers in the ceramic industry, the pottery industry, the glass industry. Excessive strain is placed on back, shoulders, abdominal muscles, and the heart muscle. Proper precautions should be taken either by providing mechanical lifting appliances where practicable, or if lifting operations are done by hand, providing suitable aids in order to reduce vertical lift as much as possible.

Regulations for Pottery Workers

The heart is a muscle, it may get tired by overstrain just as arm muscles or leg muscles get tired. Experts state that men should not lift loads more than 130 lb. in weight, and women not more than 65 lb. for intermittent work and 50 lb. for continuous work. Raising a load from the feet is particularly difficult.

It is interesting that in the British Special Regulations of 1950, for pottery workers restrictions are given on the load to be lifted. A woman may not be employed to lift or carry by herself saggars weighing with contents more than 30 lb., nor to lift with another person saggars weighing over 50 lb., nor may she stack saggars to such a height that the bottom of a saggar is more than 4½ ft. (137 cm.) above floor level; provided that the weights may be, respectively, 50 lb. and 80 lb. if the loads are not moved more than 6 ft. (about 2 metres) on about the same level. A young person may not lift or carry weights above 20 lb. without a medical certificate, which shall state the maximum weight to be lifted by him.

How Lifting Affects the Heart

A healthy heart, well trained by long practice, will not revolt against extra-strain imposed by heavy lifting. Repeated overstrain may enlarge the heart muscle. We call such enlargement "Athlete's Heart." Signs of breathlessness, heart palpitation, giddiness, fatigue, pain in the heart region are the normal answer of the body to physical strain. Healthy workers require considerable exertion before they have a feeling of distress. Weaker men require less exertion.

Best advice is to avoid over-exertion and call a fellow-worker for assistance when lifting heavy loads. A ceramic worker who has overstrained himself, had better put in a few days of rest. This is the best way to bring the heart back to normal.

How Lifting Affects Nerves

A pottery worker overstretched his right arm while he was carrying a heavy load, probably in connection with a brisk movement.

The next day he felt a dull pain in his right shoulder. An important nerve had been under pressure. He could not move his arm in the normal way. The nerve fibres are wrapped in a good layer of fat or connecting tissues. In some places they are more superficial; strong pressure may hurt the fibres. Traction on the arm, a fall on the shoulder, or pressure on the shoulder from above by a heavy load may affect such nerves.

The arm muscles then feel weak, they lose strength. Arm or hand may become paralysed. A nerve going to the muscles of the shoulder is the long thoracical nerve. When it is injured by excessive strain after carrying a heavy sack, recovery may need time. Proper treatment and avoiding heavy loads will restore the normal function.

A Cause of Backache

The onset of acute backache (lumbago) may be dramatic in its sudenness. A ceramic worker lifts a heavy load which puts strain on his back muscles. Some muscle fibres are ruptured; he is struck with agonising pain in the small of the back. He cannot move, has to lay down. Later the pain eases, he can get up again. Other cases are not as

fortunate, they cannot move by themselves. Particularly while working in stooped or twisted position, a sudden movement may injure the back muscles.

Though lumbago is very acute and disabling, return to normality may be quick. There is every reason not to repeat the heavy exertion for a long time since there is danger of recurrence.

Advantages of Materials Handling Devices

Many jobs in the ceramic industry are performed more satisfactorily by mechanical aids. Where this is not possible, the best means of lifting the loads by hand have to be decided, taking into account whether construction of platform, racks, benches, etc., will reduce the amount of vertical lift required.

Continuous standing at hard work and lifting heavy loads may produce weak foot and flat foot. A worker who must stand the whole day and lift and carry heavy loads, may suffer from pain in foot and back, cramps in the calves and burning sensations in the soles of his feet.

The feet carry the weight of the body. Additional overweight in lifting loads presses the arches down, flat feet develop. Arch supports may bring relief. Many working people have good results with them. There are factory-made and there are individually constructed arch supports.

Causes of Hernia

Workers are more prone to accidents and injuries due to muscular strain when they are indisposed. Lighter work should be provided for these occasions. The employer who studies the hazards peculiar to his plant or shop where lifting operations are undertaken, can take necessary steps to prevent this common cause of injury. Experienced workers can do much good by demonstrating the correct methods of lifting.

A hernia or rupture is a protrusion of a loop of intestines through a weak spot on the muscle wall of the abdomen. This loop cannot be seen, it is covered with skin and fat. All

that can be seen is a small lump under the skin. Normally the belly muscles are one firm wall. But sometimes there are small gaps between the muscle fibres. Here the content of the belly may press forward in the groin or just below the groin on the thigh.

A violent exertion, sudden strain, lifting or pushing a heavy load may enlarge the gap and cause a hernia. Trusses are not always sufficient to keep the hernia back. An operation may be necessary to restore full working capacity to a man suffering from a hernia and who, working in the ceramic industry, cannot avoid lifting heavy loads.

What Can You Do?

Get help whenever you have to lift or push or carry a heavy load. Don't mind the time and trouble getting the help.

If you have to lift or carry a heavy load, carry it close to the body. Keep the back as straight as possible. Place the feet close to the base of the object to be lifted.

This is important because it prevents the back muscles from taking all the load. Lift with leg and arm muscles. Bend the knees outward and "straddle" the load somewhat, keeping the back as straight as possible.

If you have to change your direction when in the upright position, be careful not to twist the body. Turn your body with changes of foot position.

But most important of all, never be afraid to ask for help in handling a heavy load!

TABLE SET FOR SWEDISH ROYAL HOUSEHOLD

SPECIALISTS in crystal table-ware and suppliers to many royal households, including those of Sweden, Denmark, Ethiopia and Iran, Kosta Glassworks, the oldest glass-making factory in Sweden, has recently been honoured by an order for King Gustav Adolf of Sweden. It consists of a full table-set of glasses for 250 persons.

Well-known as an art connoisseur, who always takes a keen personal interest in the furnishing of his royal apartments, the King of Sweden and his Queen have had a number of conferences with the firm's architect, seventy-year-old Ellis Bergh, in order to plan a design to their liking. The result is a set of glasses which is a happy blend of the modern with traditional style. It is distinguished, simple and nicely balanced. The prism-cut stems of the goblets are well-proportioned and the fine lustre of the Kosta crystal is enhanced by the cut as well as by the thinness of the bowls.

A specimen of work by Ellis Bergh, 70 year old Kosta architect

The latter are adorned only with the King's monogram. Each set will consist of four goblets and one seltzer glass.

Ellis Bergh recently celebrated his twenty-fifth anniversary with the Kosta Co. During this time he has designed no fewer than 150 different glass services. Whether it be heavy cut crystal or paper-thin undecorated hand-blown bowls each has a clean-cut architectural style for which Bergh has come to be famous.

As Crown Prince, the King was already a patron of the Kosta works having had designs executed to order. Several other members of the Royal Family are also customers.

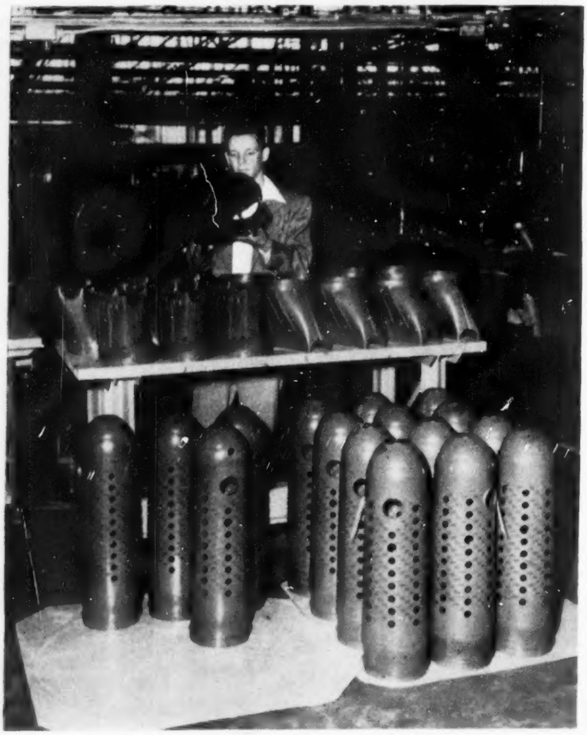
Not long ago Kosta supplied the glass service to the new banquet rooms of the Swedish Foreign Office, which recently moved back into its restored and renovated premises, a 17th-century palace and a one-time home of younger members of the Royal Family. These glasses bear the Swedish symbol of the three crowns, which is their only adornment.

Among other important commissions recently executed by Kosta is a delivery of glass table services to all of Sweden's twenty-four Provincial Governors. Basically these are similar to each other, though each set is engraved with the coat-of-arms of the province for which it is intended.

Kosta is one of the two largest glass-works in Sweden, the other being the Orrefors Works.

CERAMIC COATINGS FOR JET COMPONENTS

CERAMIC coatings made by the Ryan Aeronautical Company in the U.S. are being applied to jet engine components. Eminently successful in extending the service life of high temperature exhaust systems for piston engines, the thin protective coatings are being applied experimen-



Ryan-made transition liners (top) and combustion chambers (bottom) which have been ceramic coated prior to shipment to General Electric's Lockland, Ohio, plant. They will be subjected to actual jet engine tests to determine their ability to stand up under jet engine environment

tally to combustion chambers and transition liners for General Electric J-47 jet power plants.

Under the direction of the Ryan Development Laboratories, these "hot end" components have been fabricated from stainless steel, type 321, ceramic coated and shipped to G.E.'s Lockland, Ohio, plant for evaluation. They are undergoing "hot" engine run tests with two objectives; to determine if the type 321 stainless steel-ceramic combination will stand up as well as standard parts made from Inconel and to observe the behaviour of the ceramic coatings under the ravages of jet engine environment.

Added impetus for the investigations exists in the critical scarcity of nickel which comprises 70 per cent. of the Inconel alloy now used in the combustion chambers and transition liners of jet engines. If type 321 stainless steel, which contains only eight to eleven per cent. nickel, can be substituted for nickel-rich Inconel, a substantial saving of the white metal will be realised.

The thin coatings of Ryan ceramic have been applied to the stainless steel surfaces in order to protect them against rapid oxidation at flaming temperatures. With a lower resistance to high temperature oxidation than Inconel, type 321 stainless steel requires this surface treatment in order to withstand the intense ravages of life in a jet engine.

In three years of comprehensive flight testing, it has been shown conclusively that the Ryan ceramic coatings have extended the service life of exhaust systems for piston engines in aircraft. The tightly-adherent coatings have resisted chemical and physical change normally occurring in the presence of flaming gases whose temperatures run as high as 1,800° F. As a result of their stamina and tenacity, the metal exhaust systems have been protected against deterioration by oxidation, carbon absorption and corrosive attack.

It is interesting to note that service life conditions encountered in jet engine combustion chambers and transition liners are quite different from those found in exhaust components for reciprocating engines. In these jet engine parts, pulsating pressures, as well as withering temperatures, are prevalent to attack the ceramic coatings.

Tests are also being conducted with combustion chambers made of Rosslyn Metal. In this instance, the successful performance of this sandwich-type metal would not only save nickel but may improve thermal characteristics. With a one-third centre slice of copper, Rosslyn Metal reduces the need for nickel, cobalt, tungsten and other short-supply metals by that amount. Because of its extremely good lateral conductivity of heat, highest of all heat-resisting materials, Rosslyn Metal may eliminate "hot spots," or accumulations of heat, in the walls of jet components.

INTERNATIONAL GIFT AND FANCY GOODS SHOW OF AMERICA

24th to 30th August, 1953

CERAMICS will be one of the leading features at the forthcoming International Gift and Fancy Goods Show which has just been officially announced. A great number of manufacturers of ceramics from all parts of Europe have already indicated their showing at this new International Trade Fair in the United States, which will be dedicated exclusively to the wide field of gift-ware.

The Show will be held in four large Exhibition Halls of the world famous Astor Hotel. It is an open show with stands or booths, not a hotel-room show. Booths of all sizes will be available, the smallest being 75 sq. ft. There is no objection to two or more firms sharing one stand in order to reduce costs to the individual exhibitor. In other respects as well, the management is endeavouring to enable small manufacturers which are in the majority in the giftware line, to participate in this show. The London office will e.g., have a special service to bring such smaller manufacturers together who may find, that by joining, or taking part of another manufacturer's stand, they can reduce their overall costs and thus be represented at the show.

The show will be open to the trade only, from Monday to Friday; Saturday (29th) and Sunday (30th) it will be open to the general public. Public days have been found from experience to be of the greatest value at International Shows from a promotional point of view. A further attraction for exhibitors will be the fact that sales to the public will be permitted, without restriction, on these two days. There is no limit to the amount of samples an exhibitor will bring to the show, and their sales on the last two days of the event. Advertising of the public days in the New York papers is expected to attract many thousands of New Yorkers. At the recently held Italian and Spanish Trade Shows in New York, more than two million dollars of samples have been sold to the public.

The show is organised by the well known Charles Snitow Organisation which owns and manages a number of the largest and long established American Trade Shows, such as The National-Hardware Show, The World Hobbies Show, International Motor Sports Show and many others, and is being widely publicised in the United States, particularly in the Trade Press covering the main lines of giftware and fancy goods. In addition to thousands of American buyers, substantial numbers of buyers are also expected from South American countries, Canada, Bahamas, Jamaica and the Philippines.

Early application for space is strongly advised to avoid disappointments. Space will be allocated in order of applications received. Full particulars, floor plans, etc., can be obtained from the European Head Office of the Show at Dudley House, Southampton Street, Strand, London, W.C.2. (Phones: Temple Bar 8947 and Temple Bar 7641.)

WORK MEASUREMENT

AT the first joint meeting held by the Stoke-on-Trent and District sub-branch of the Institute of Cost and Works Accountants and the North Staffordshire Society of Time and Motion Study Engineers, held recently at the Jubilee Hall, Stoke, Professor T. U. Matthew (Lucas Professor in principles of engineering production at Birmingham University) discussed "Work Measurement."

At question time, Professor Matthew was asked if he agreed with the view of another expert that the use of M.T.M. (Methods - Time - Measurement) would endanger industrial relations.

Professor Matthew replied that in gaining the approval or acceptance of the worker in the use of the stop watch there must be a certain amount of educational work. There should not be any serious industrial upheaval or misunderstanding when the use and limitations of M.T.M. were known.

He was asked how the time study engineer could satisfy the operator at the outset that time study was a fair technique, properly applied, and that the "value" was being properly set.

Professor Matthew said the best answer was in including a trade union representative in the training scheme

for time study. Personal relationship between the study man and the operator was the important point.

Mr. J. Borsay (President of the Manchester and District branch of the Institute of Cost and Works Accountants), who presided, was introduced by Mr. M. M. Calonier (President of the North Staffordshire Society of Time and Motion Study Engineers).

Among the visitors were the Deputy Lord Mayor (Alderman H. Barks), Mr. J. V. Goddard (President of the British Pottery Manufacturers' Federation), Dr. H. W. Webb, O.B.E. (Principal of the North Staffordshire Technical College), and Dr. E. R. Patrick (head of the Engineering Department of the North Staffordshire Technical College).

(*Evening Sentinel, 2nd March, 1953.*)

USING WASTE HEAT IN THE HEAVY-CLAY INDUSTRY

THE following is an abstract of a paper by E. Rowden, read at the Clay Convention, Torquay, on the 5th May, 1951, and published in the February, 1953 issue of the Transactions of the British Ceramic Society:

Methods of using waste heat from intermittent and from continuous kilns are dealt with in detail; reference is also made to the recovery of waste heat from steam plants.

Tests on intermittent kilns showed losses of 35-50 per cent. in the flue gases, and 25-40 per cent. in the kiln structure, fired goods, and setting materials at the finish of firing, which were wasted during cooling. A typical method of inter-connecting rectangular kilns and the Minter system for inter-connecting round kilns to recover heat from the flue gases are described, together with methods for the recovery of hot air from intermittent kilns during cooling. Observations are made on the savings to be obtained, cost of installation, life of the ducts and methods adopted to increase the life of ducts, dryer cars, car superstructures and pallets. The design, operation and fuel consumption of two plants are given.

Systems for using waste heat from continuous kilns in Germany and in this country are described. Both building-bricks and roofing-tiles in Germany are dried in Keller corridor dryers with hot air drawn from the cooling-zone of Hoffman and Zig-zag kilns and with exhaust steam from the engine that drives the machinery. At several plants in this country it has been found possible to dry wire-cut bricks, to a condition suitable for setting, in car-tunnel dryers, with hot air from the cooling-zone of tranverse-arch chamber kilns and exhaust gases beneath the floor of the dryer. Fuel consumptions are given for both German and British plants. Systems at particular plants described in detail, with the results, include: drying wire-cut bricks (1) by hot air from a chamber kiln; (2) by hot air and exhaust gases from a chamber kiln; (3) by hot air and exhaust flue-gases from a chamber kiln and combustion products from a coke fire, and (4) in a tunnel dryer by hot air from a car-tunnel kiln.

Thos. W. Ward Ltd.—Thos. W. Ward Ltd., Albion Works, Sheffield, inform us that they have been appointed official general distributors of the "Staffa" mobile crane, and "Wetherill-Hydraulic" load shovels.

A GLASS-FIBRE CAR BODY

A NEW glass-fibre motorcar-body, first of its kind in the world, has recently been developed jointly by the Glasspar Company of California and the Naugatuck Chemical Division, U.S. Rubber Company.

The body, which is dent-proof and rust-proof, is constructed of Naugatuck Chemical's Vibrin polyester plastics and layers of glass fibre, a combination which, for its weight, is stronger than steel; it is also very resilient.

The body, moulded in one piece, is approximately ⅕ in. thick and weighs only 185 lb., and it will not dent under the punishment of accidents which now result in crumpled fenders and doors. Because of its resiliency, the Vibrin-glass combination springs back to its original shape after impact. Breaks are possible under heavy impacts, but the material can be easily and cheaply repaired.

It will neither rust nor oxidise and it will hold paint well.

To test its strength, it was driven deliberately into a tree at a speed of twenty-five miles per hour. The test resulted in a crack approximately 14 in. in length at the point of impact on the right side of the car near the windshield. The crack was repaired with a patch of glass fibre and plastics within one hour.

The Glasspar Company has been manufacturing boats ranging from 8 ft. sailing dinghies to 20 ft. cabin cruisers out of the same Vibrin-glass material. It became interested in the material for car body construction early last year when it started production of removable hard tops for the foreign cars now in widespread use in the United States.

William Tritt, president of the Company, designed the present automobile body.

The new glass-fibre body entirely aside from its toughness, permanence and wearing qualities, has one big advantage which is attractive to the car manufacturer: It can be formed and shaped without the use of extremely expensive moulds and heavy plant equipment.

The moulds, presses and other equipment used by reinforced plastics moulders represent an extremely small fraction of the investment cost for metal-fabricating dies and machinery.

CIRCLE CUTTING MACHINE

WE have received from Harmans Engineering Co., Barnstaple, North Devon, a leaflet illustrating a new universal circle cutting machine which will cut rings and discs up to 11½ in. dia. in a wide variety of materials including glass, paper, cork, felt, rubber, etc. It can therefore be used for cutting glasses for instruments and lamps, and also many types of gaskets, rings and washers.

Vibrin plastic-glass fibre car body weighs approximately 185 pounds. Its average thickness is 2/10 inches

It consists of a baize-covered turntable mounted on a cast base. An overhead bar carries a cutter head which can be locked at any radius from the centre of the table and also a removable centre head which is used to locate and clamp the material when necessary. Interchangeable cutters, including a glass cutter, are provided for use on different materials.

In use, the material is placed on the turntable and located and clamped in position by screwing down the clamping spindle in the centre head. Having set the cutter head to the required radius the cutter is depressed on to the material with the finger, while the turntable is rotated by hand. The method of applying the pressure to the cutter allows very sensitive control of the cut to be maintained. The overhead bar can be removed, leaving the turntable unobstructed for paint-spraying or welding, etc.

Machines are also available with capacities exceeding 11½ in.

THE RONSON-WEDGWOOD

The Ronson Wedgwood, a table lighter movement incorporated in a Wedgwood Jasper base which carries cameos of the Queen and the Duke of Edinburgh. This is to be manufactured in two sizes, being an item from the Ronson range of special Coronation material

A NEW INSULATING MATERIAL

A NEW type of opaque glass, composed of myriad tiny cells, that floats like cork, can be sawn or drilled with ordinary tools and can be used as the buoyant element in the construction of life-boats, life-rafts, life-preservers, and pontoon bridge supports has recently been developed by the American Pittsburgh Corning Corporation.

The new product, called "Foamglas," has valuable insulating qualities, too. It has a weight of only 10 lb. per c. ft—one-fifteenth that of ordinary glass—and is odourless, fireproof, and vermin proof.

It is now under active investigation as an alternate material for such critical products as cork, balsa wood, cellular rubber, and kapok, which are largely imported to the U.S.

"Foamglas" does not resemble any form of glass heretofore manufactured; it is extremely light in weight.

The glass-making industry is thousands of years old, but in all its long history it has made use of relatively few methods for forming its products. Even in the recent decades, when technical progress has been rapid, glass has been fabricated almost entirely by some combination of blowing, pressing, rolling, or drawing. To these is now added a "cellulating" or "foaming" process—and the result is the new basic material which should find wide use in many fields.

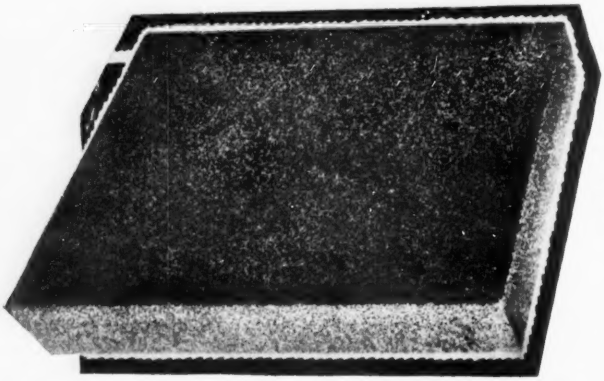
"Foamglas" is produced by firing ordinary glass which has been mixed with a small quantity of pure carbon. At the proper temperature the glass softens and the carbon turns into a gas which then acts upon the molten glass very much as baking powder or yeast behave when bread is baked. By proper selection of the glass batch, the type of carbon, and by exact control over the times and temperatures used, it is possible to obtain rigid vitreous slabs of the new glass in which the cells are uniformly small in size and entirely sealed one from another. As a matter of fact, a section of it is nothing less than a mass of tiny, sealed air chambers—so many that a cubic foot contains over five million of them—and it turned out to be a valuable substitute for materials made unavailable or scarce by wartime demands.

FACING BRICKS FROM STEELWORKS SLAG

PRODUCTION of facing bricks of high quality from steelwork furnace slag is proposed by Colvilles Ltd. in their annual report. This recalls the successful development of Colvilles-Clugston Ltd. in which the former hold a 50 per cent. interest, to dispose of furnace slag.

The company has now worked out a process for the manufacture of high quality facing brick from slag. Orders have been placed for the first unit of plant to allow manufacture of the facing bricks on a commercial scale; after further experience and on achievement of complete satisfaction with the resultant products, Colvilles-Clugston Ltd. will duplicate the units to take up all the slag available.

Policy of the company is to seek utilisation of all the waste products of the steel industry, either in civil engineering work or in alternative outlets and this latest development is a further stage in the process of making the maximum use of raw materials at every stage of production.



'Foamglas'' has valuable insulating qualities, weighing only 10 lbs. per c. ft. it is odourless, fireproof and vermin proof

From the Copeland-Spode factory at Stoke-on-Trent, where fine china and earthenware have been manufactured since the reign of George III, comes this hand-painted mug and beaker commemorating the Coronation of Queen Elizabeth II

SPODE CHINA FOR ROYAL TOUR

EXAMPLES from three china dessert sets made by the Copeland-Spode works from which the Queen and Duke of Edinburgh will dine when they visit New Zealand next December were shown recently at a private exhibition of Spode fine china and earthenware in London.

The service, executed under the personal direction of Mr. Ronald Copeland, for Lord and Lady Freyberg in 1948 when Lord Freyberg was Governor-General of New Zealand, was intended for use at the state banquet in Wellington for the visit of the late King George VI and Queen Elizabeth, the Queen Mother. But the tour, planned for January, 1949, was cancelled because of the King's health.

All three sets at the exhibition—which depicts the products of W. T. Copeland and Sons Ltd. from 1770 to the present time—consist of fourteen dessert plates, two round dessert dishes and two square dishes. There are fifty-four pieces in all.

The first set depicts eighteen different species of fern native to New Zealand, which is famous for its wide variety of fern growth.

The second set is decorated with eighteen of the wild birds of New Zealand and the third set portrays eighteen of the country's wild flowers.

POTTERY EXPORTS

THE value of pottery exports in January was £1,708,982, compared with £2,821,235 in January last year, and £2,088,402 in the first month of 1951.

The volume of pottery shipments in January was 419,854 cwt., compared with 587,362 cwt. in January last year, and 477,758 cwt. in the first month of 1951.

GLASS PRODUCTION UNDER INDIA'S FIRST FIVE YEAR PLAN

DETAILED programmes of industrial development have now been published by the Indian Government Planning Commission in connection with its first Five Year Plan. Approved by Parliament in December last this plan covers the period 1951-56.

During this period some Rs. 22 million is scheduled to be invested by the Government in privately owned glass manufacturing firms and increased production is looked for. Output is expected to increase as follows:—

	Production	
Product	*1950-51*	*1955-56*
Sheet glass	5,850 tons	26,000 tons
Blown ware and pressed ware	86,000 tons	137,500 tons to 142,500 tons
Bangles	16,000 tons	16,000 tons

ADVERTISERS' INDEX

This is an Arrow Press Publication. Published Monthly.
Subscription Rate 25s. per annum.
Published by Arrow Press Ltd. at 157 *Hagden Lane, Watford, Herts.*
Telegrams: "Techpress, Watford." Telephone: Gadebrook 2308/9.

MADE AND PRINTED IN GREAT BRITAIN FOR THE PROPRIETORS, ARROW PRESS LTD., BY THE SIDNEY PRESS LIMITED, LONDON AND BEDFORD.